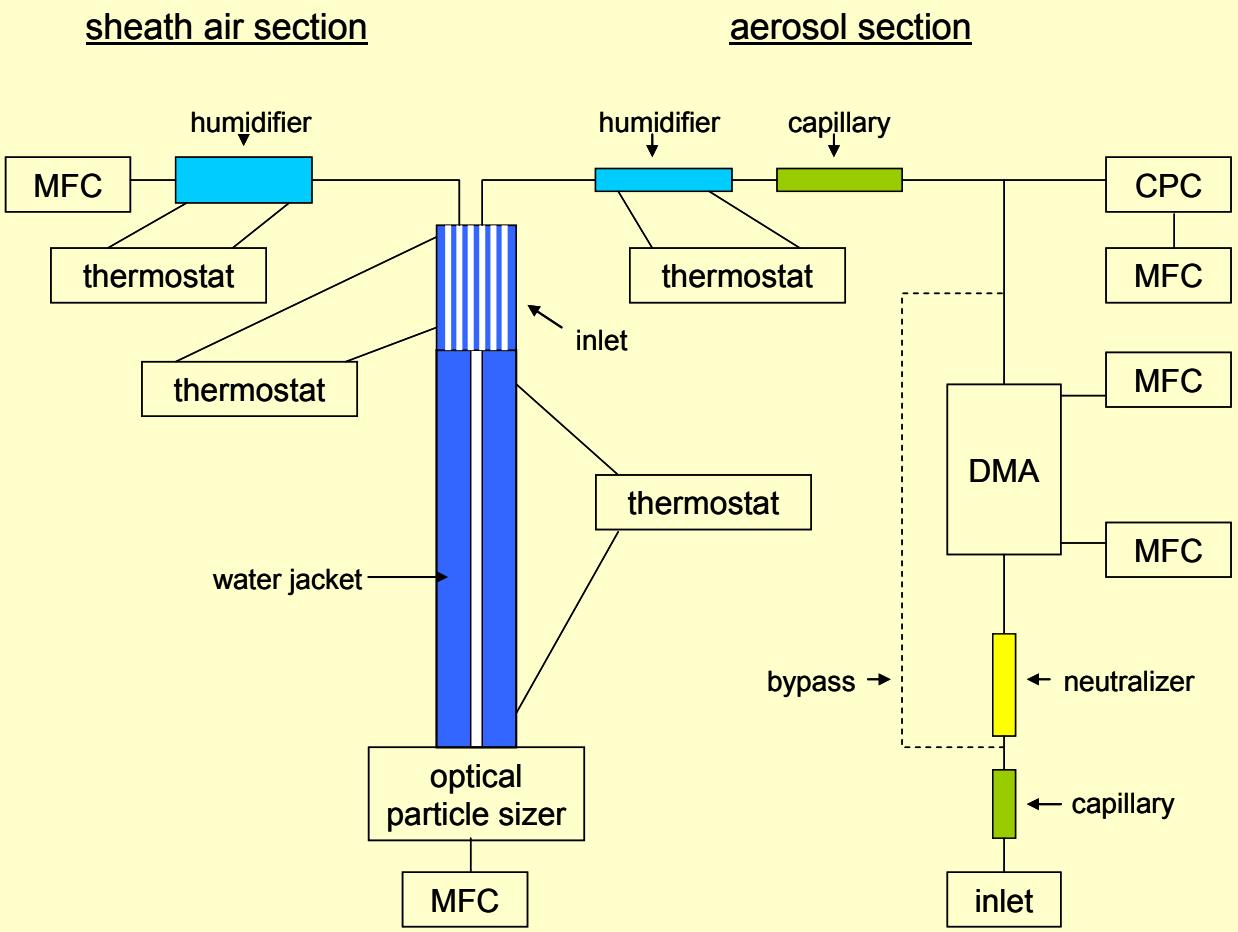
Activation and hygroscopic growth of coated and uncoated soot particles:

Results from DMT-CCNC & LACIS-mobile

Content

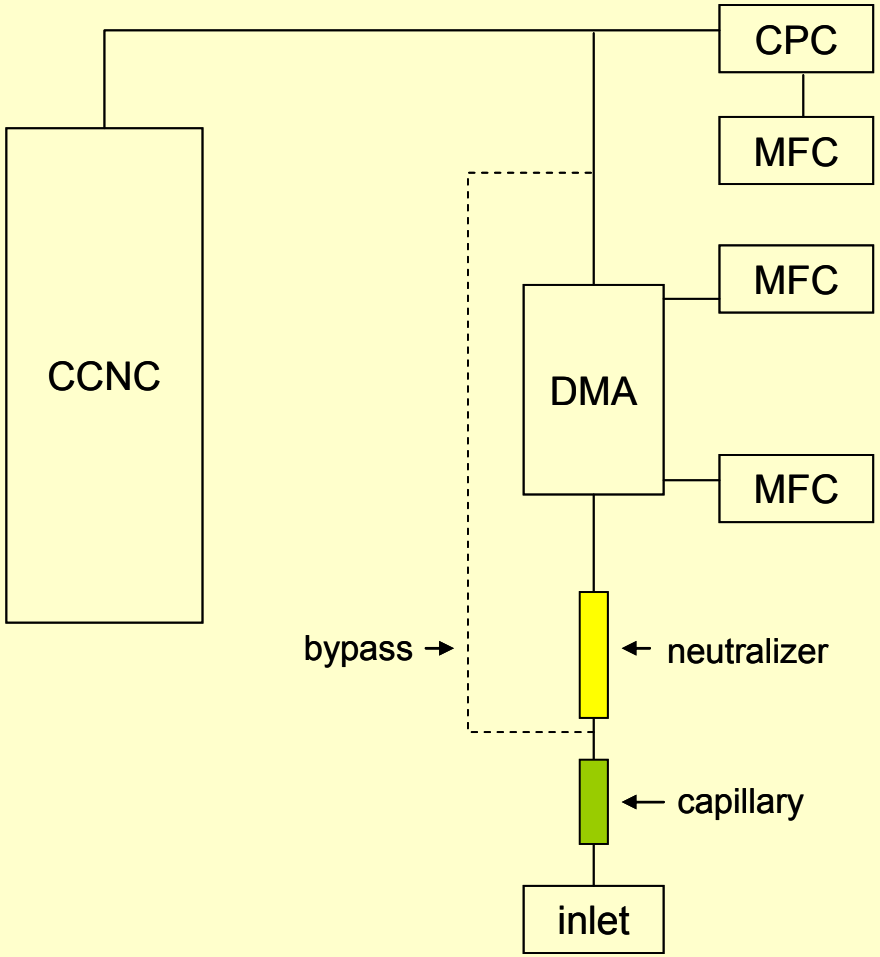
- Setup LACIS-mobile and DMT-CCNC
- Hygroscopic growth and activation of different soot-types:
  - uncoated GFG1000-soot with nitrogen or argon as carrier gas
  - GFG1000-soot coated with succinic acid
  - uncoated CAST-soot with different organic carbon contents
  - CAST-soot coated with sulfuric acid and different organic carbon contents
  - CAST-soot coated with succinic acid
- ‘closure’ between DMT-CCNC and LACIS-mobile

Set-up LACIS-mobile



- relative humidity: up to 98.4%
- particle size: 200nm @ n=1.59
- measurement: at constant dry particle diameter varied relative humidity

Set-up DMT-CCNC



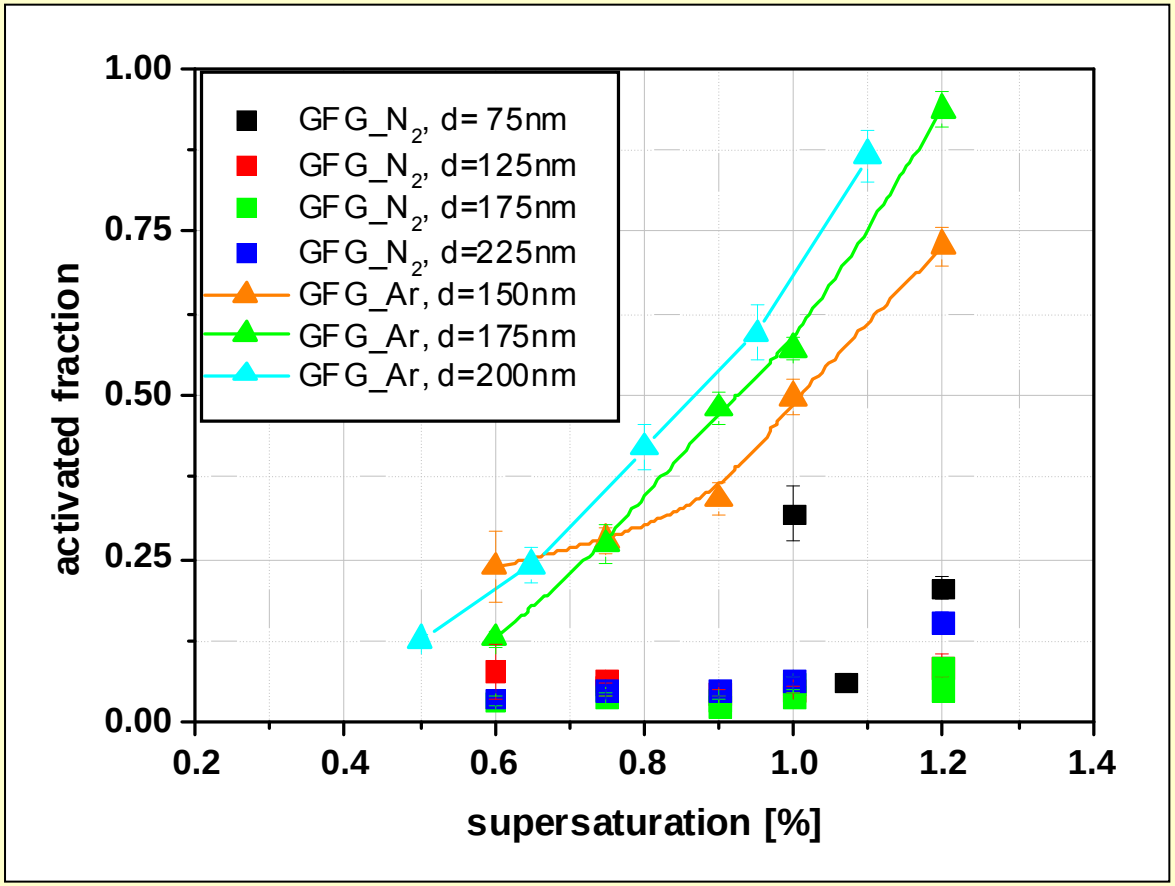
- critical supersaturation: 0.07% - 1.1%
- dry diameter: 50nm – 300nm
- measurements: at constant supersaturation varied dry particle diameter ($AF=f(d_{p,0})$)

Uncoated GFG1000-soot

hygroscopic growth

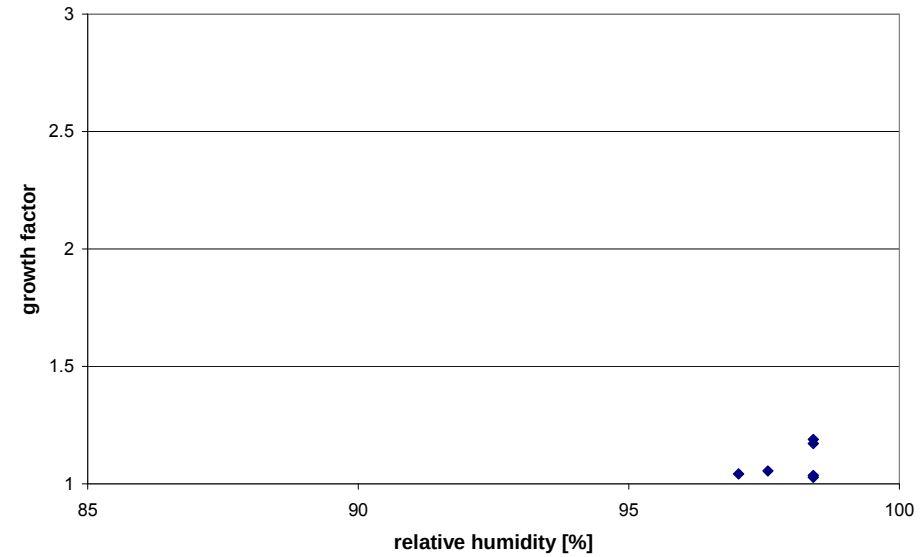
	r.h. [%]	GF
Ar	98.41	1.03
N_2	no growth observed	

activation

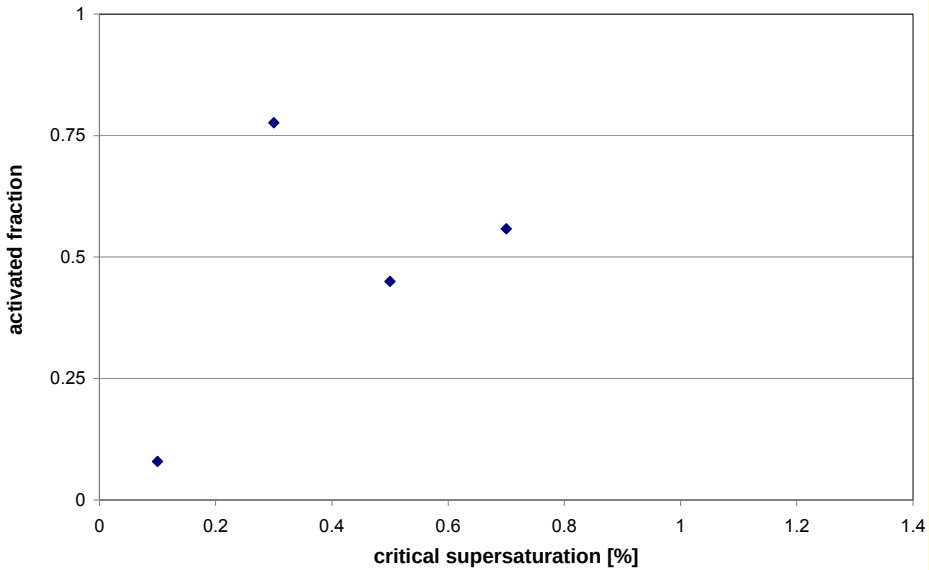


GFG1000-soot coated with succinic acid

hygroscopic growth



activation



- no full activation observed
- evaporation of succinic acid ?

GFG1000-soot coated with oxalic acid

hygroscopic growth activation

- neither hygroscopic growth nor activation observed
- evaporation of oxalic acid?

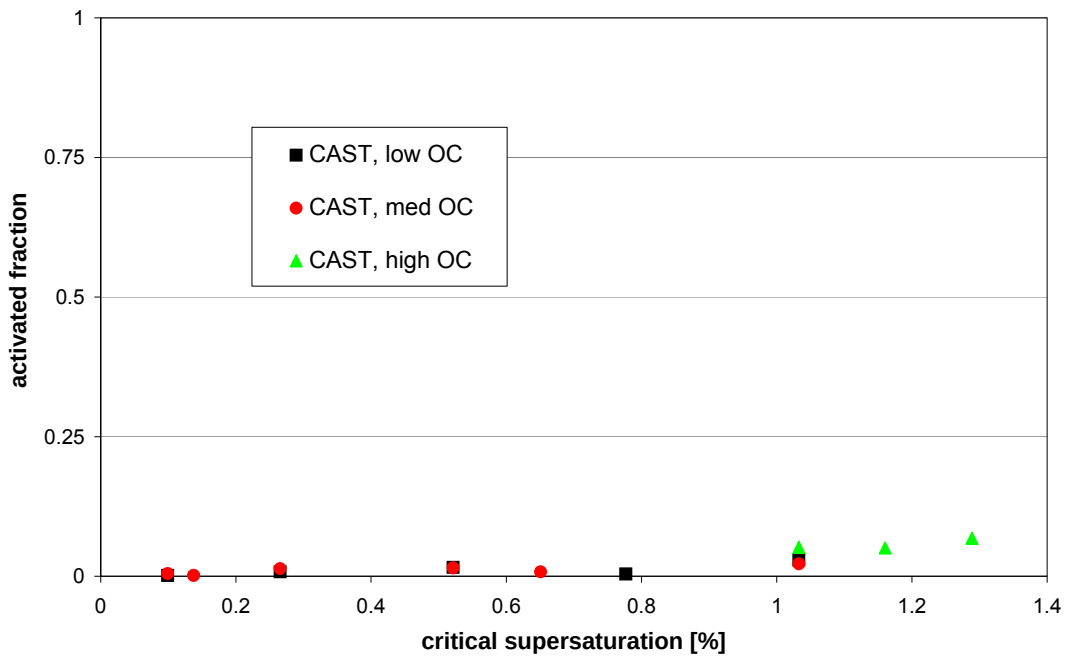
Uncoated Cast-soot

hygroscopic growth

OC	r.h.	GF
low	98.41	1.04
med	98.41	1.04
high	no growth observed	

- similar growth to uncoated GFG-soot

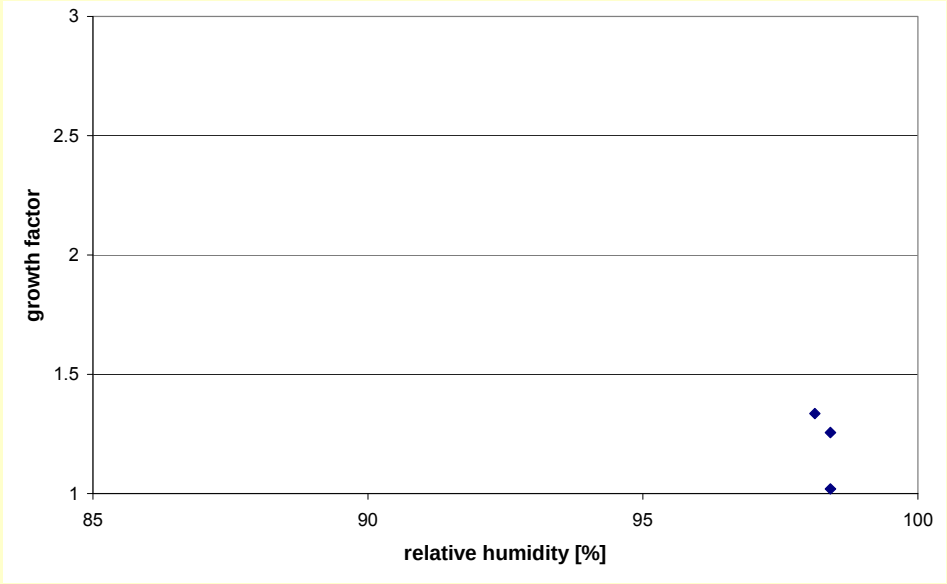
activation



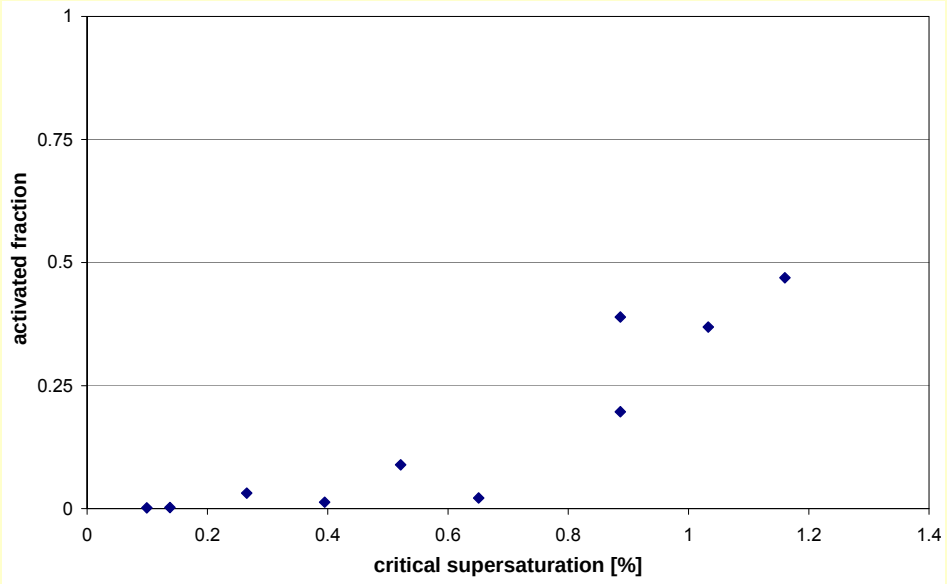
- no activation observed (all OC-contents)

CAST-soot coated with succinic acid

hygroscopic growth



activation

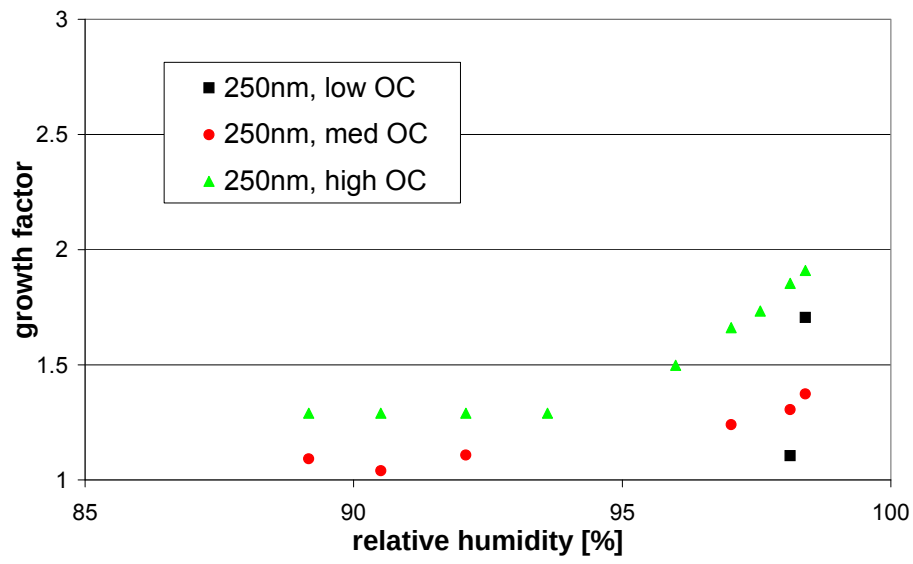


- hygroscopic growth larger than for GFG-soot coated with succinic acid

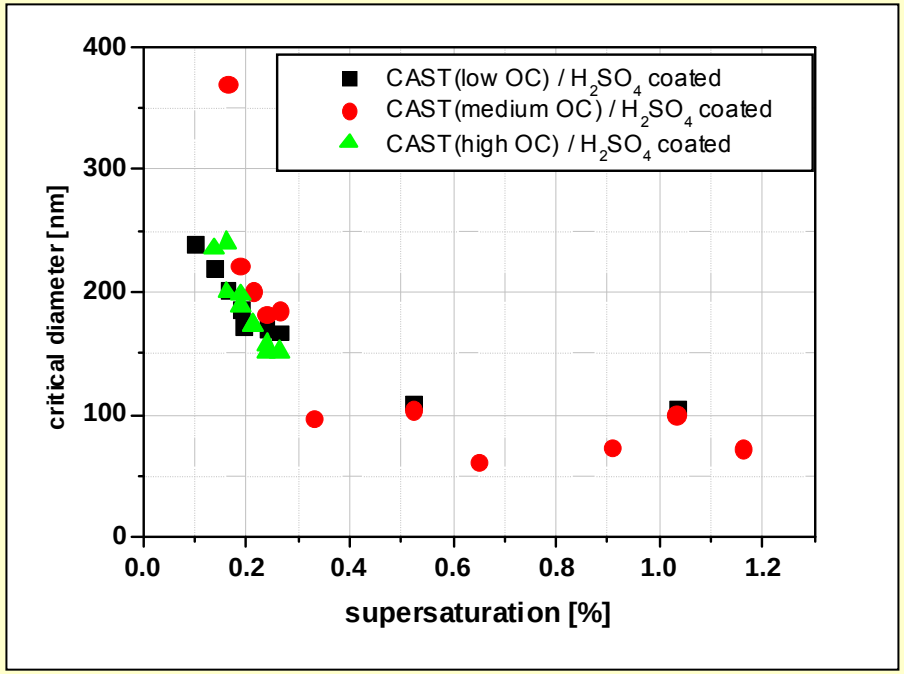
- no full activation observed
- evaporation of succinic acid ?
- activated fraction lower than coated GFG-soot

CAST-soot coated with sulfuric acid

hygroscopic growth



activation

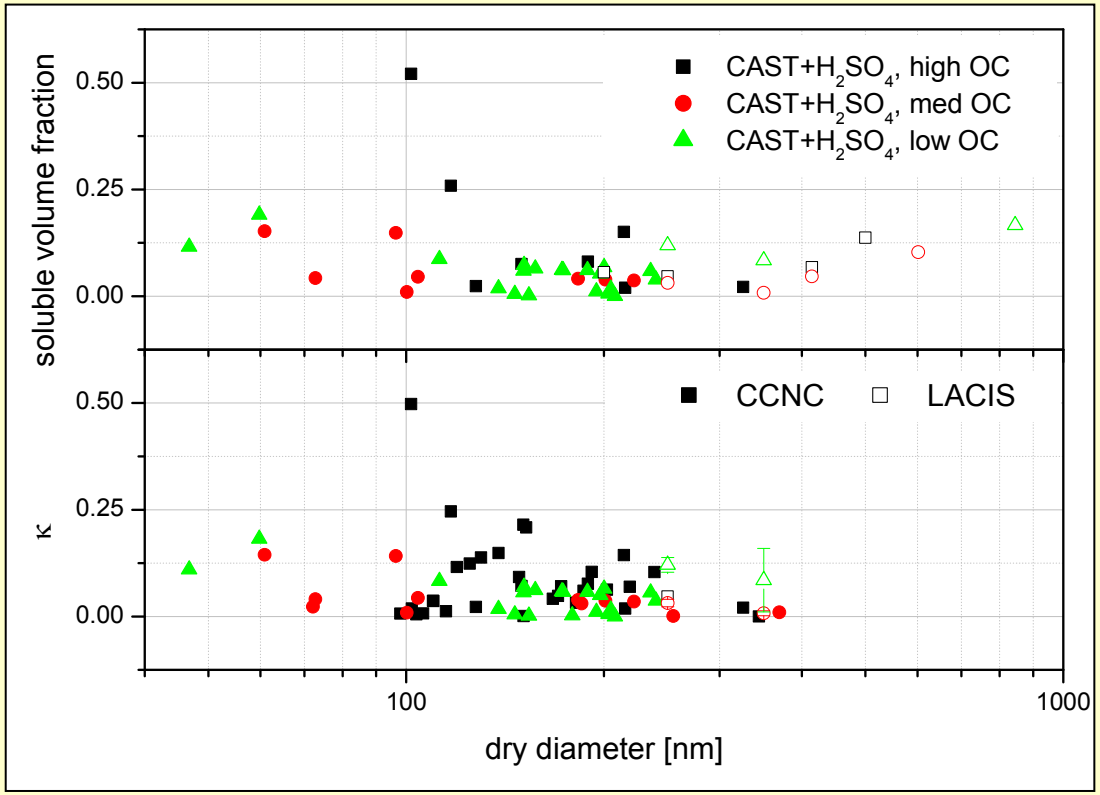


- hygroscopic growth increase with increasing OC-content or masked by sulfuric acid coating

- activation independent from OC-content or masked by sulfuric acid coating

‘Closure’ between hygroscopic growth and activation

- derived soluble volume fraction and κ from hygroscopic growth and activation measurements



Summary

Soot type	hygroscopic growth	activation
GFG Ar	✓	✓
GFG N_2	o	o
GFG + succinic	✓	o nf
GFG + oxalic	o	o
CAST	✓	o
CAST + succinic	✓	o nf
CAST + sulfuric	✓	✓

Summary

- CAST-soot coated with sulfuric acid: from hygroscopic growth and activation measurements derived ‘soluble volume fraction’ independent from selected diameter
- ‘soluble volume fraction’ around 0.1
- preliminary results:
  - no data on coating thickness, which are needed for calculation of optical response curves
  - influence of core shape and particle shape to mobility-diameter selection and optical data inversion neglected